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YORP AND YARKOWSKI EFFECT ON SPACE DEBRIS WITH HIGH-AREA-TO-MASS RATIO AND
ITS CHARACTERIZATION WITH OPTICAL SENSORS FOR ACCURATE ORBIT PROPAGATION

Abstract

So-called YORP and Yarkowski effects have been subject to intense investigation in the research on asteroid dynamics, but have been of diminished interest in the area of near Earth artificial objects to date. However, this paper demonstrates their relevance for space debris objects, especially for a group of objects called HAMR, with very high area-to-mass ratios. In realistic simulations of HAMR objects assuming standard multi layer insulation as object materials, the order of magnitude of direct radiation pressure effects, hence YORP and Yarkowski, on both attitude and orbital parameters is shown. In a second step, methods to characterize these shape and attitude dependent effects with ground based sensors are shown. The characterization is necessary to establish a priori models in the absence of precise information on the shape and size of these objects, which in reality is not available for unknown and newly detected objects. The a priori models are needed in the accurate orbit propagation. The improvements which result from the correct modeling of these effects using the a priori models are shown with respect to the orbit propagation and to the successful redetection.